

Feature

A GROWER'S GUIDE TO BCN

At BeetTech20, BBRO's winter technical events, the topic of Beet Cyst Nematode (BCN) was discussed and the delegate voting buttons revealed many growers don't know how to identify or diagnose BCN in their fields. BBRO's Head of Knowledge Exchange, Simon Bowen, asks Dr Alistair Wright (who studied BCN for his PhD) some questions to help every grower understand what it is and how to manage it.



Dr Simon Bowen
Head of Knowledge Exchange, BBRO



What is BCN?

The beet cyst nematode, *Heterodera schachtii*, is a microscopic worm which feeds from the fibrous roots of sugar beet and other hosts. The nematodes are soil-borne and can persist in infected fields for a long time, sometimes well over ten years. Eggs which contain the infective juvenile nematodes remain dormant inside a protective cyst for many years, waiting for the right conditions in which to hatch. Juveniles must swim through the soil to reach a host such as sugar beet or oilseed rape. When they reach the host, they invade the roots and start feeding from the plants. As they grow and mature, females burst through the roots and

expose themselves to the soil. These are the white cysts which can be seen on infested plants. When the females complete their life cycle, they mature, and their body turns into a brown protective cyst. Eventually the cysts drop off the roots and into the soil. If conditions are right, some of the eggs quickly hatch and re-infect the host plant whereas others will wait to infect plants in the future.



Fig. 1. Juvenile BCN nematode which invades host plants



Fig. 2. A mature cyst crushed open to release the eggs and juveniles inside

What are the effects of BCN on sugar beet and will climate change increase the expected yield loss to BCN?

As the nematode invades and feeds from the sugar beet plants, they inhibit water and nutrient transport in the roots. BCN is particularly damaging since it interferes with the formation of the root system and draws down nutrients and sugars from the leaves. This causes symptoms typical of nitrogen deficiency and drought to occur. In severe cases excessive root bearding occurs (Fig. 3.).



Fig. 3. Comparison of BCN susceptible (left) and tolerant (right) plants. Note the reduced shoot and root size and bearding of the lateral roots on the susceptible plant.

Climate change will undoubtedly increase the activity of BCN. Warmer soil temperatures will increase the activity of the nematode. Currently in the UK we experience between two or three generations but with a mean temperature increase of 3°C, we could see up to five generations occurring each year. This will result in earlier colonisation of plants and increased feeding throughout the growth of the sugar beet and could exacerbate yield losses.

How would I know if I have BCN? Should I soil sample for BCN and are certain soil types more prone to infection?

BCN will typically occur in patches in infested fields and will present as areas of poor growth and delayed canopy development. Between May and September, the characteristic white cysts, which are in fact the adult female nematodes, are clearly visible on infested roots (Figs. 4 and 5).



Fig. 4. Cysts are just visible amongst the roots



Fig. 5. Cysts are clearly visible under magnification

At other times of the year, or if you wish to check for BCN prior to planting your crop, you will need to arrange for a soil sample and analysis from an accredited laboratory. BBRO's plant clinic can advise on this procedure: plantclinic@bbro.co.uk.

Soil type also plays a crucial role in the nematode's life cycle. Since they are aquatic organisms, they must move through moist soil with large spaces between the soil particles. Therefore, BCN poses the greatest risk to sandy, organic and loamy soils. Growers on heavier soils are unlikely to suffer BCN issues but nevertheless should remain vigilant.

What are the hosts of BCN on the farm?

The major hosts on farm are sugar beet and oilseed rape. As a rule, all plants in the Brassica and Beet families are hosts. You should also consider BCN status of a field if you are thinking of growing novel crops such as Quinoa or Soybean as both have been shown to be hosts. Weeds such as fat hen and common amaranth are also hosts and will increase nematode populations.

How quickly does BCN decline between host crops and how should I work out my rotational break between host crops?

Approximately 50% of the juveniles in a cyst will hatch each year. This means that a cyst with 600 eggs inside will decline to around 40 eggs with a four-year break between hosts. However, that still means that there is a severe pressure to a susceptible host crop, so we encourage as long a gap as practicable. Soil sampling can be used to monitor populations and their decline.

How does BCN get spread around farms?

The most likely culprit for transfer of BCN is unfortunately the beet harvester. The cysts adhere easily to wet soil and can be moved both around the field and between fields. We recommend, if possible, harvesting BCN infested land in a block and then washing off soil from the harvester before moving to uninfested fields.

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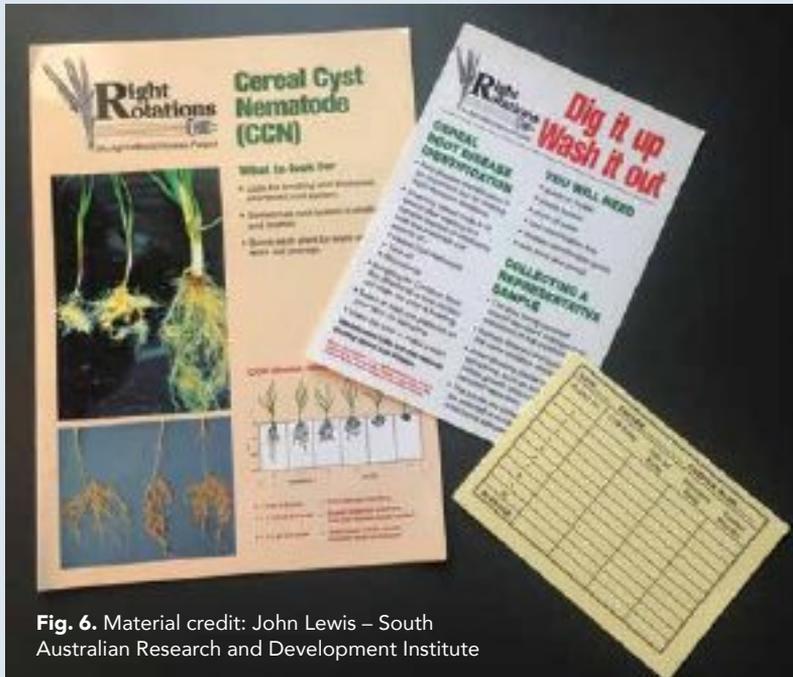


Fig. 6. Material credit: John Lewis – South Australian Research and Development Institute

Farmers in Australia have been able to tackle Cereal cyst nematode (*H. avenae*) through training to understand the severity of infestations on their crops and assist with rotation length decisions. BBRO is looking into seeing if a similar system may be deployed on your farms.

Dr Alistair Wright will shed more light on this in the next edition of beet review. (Fig. 6.).

Is weed beet an issue?

Weed beet can indeed be an issue. These should be rogued out to reduce the ability of them to produce hotspots of BCN. Even if your crop is sown with a tolerant variety, the weed beet may lack this trait and therefore could host many times more nematodes than the surrounding crop. The nematodes formed can then spread and harm the neighbouring sugar beet.

Fig. 7. The weed beet (right) is hosting many more nematodes than the sugar beet (left).



If I have BCN, do I need to be careful if growing cover crops? Are some resistant?

Brassica cover crops do have a potential to be good hosts of BCN and could lead to a build-up in populations whilst they are grown. Resistant varieties of white mustard and radishes exist and could be used instead of susceptible varieties. We recommend asking your seed merchant for information on the BCN status of your cover crops before you purchase. Some resistant radishes and mustards have been reported to reduce BCN populations, although the consensus



This photo from 2019 shows clearly the reduced canopy size of the BCN infested areas in red on all varieties compared to the controls in green. Interestingly, the tolerant varieties showed less reduction than the susceptible varieties and this resulted in better yields.

in the published literature is mixed and more research in the UK is needed before BBRO would support their widespread use for BCN management.

N.B. whilst resistant varieties are marketed as offering 70% or 90% population reductions of BCN, it is unlikely that these reflect field performances since this data is from standardised lab tests.

Can I control BCN with pesticides such as Vydate?

Vydate only offers protection to sugar beet against free-living nematode species such as trichodorus and longidorus. These nematodes have a very different life cycle and can be controlled using chemicals. However, due to the cysts and quick colonisation by BCN into a host plant they cannot be effectively controlled with vydate.

Are there varieties that can help reduce the impact of BCN on yields on my farm?

Varieties tolerant to BCN have been available to grow since 2009 and BBRO advice is to grow these wherever you have an infestation. In 2021 there are three varieties on the Recommended List: Lacewing (SEDVanderHave), Kortessa (KWS) and Daphna (KWS).

Our recent research is showing that these varieties are in fact partially resistant, and therefore do not host as many females which reduces the final population (approximately 10% of a susceptible variety). Since there is less feeding pressure on the plants, they yield better than a susceptible variety when infested. Therefore, tolerant varieties are a good option for BCN population management and maximising yield.

BBRO's BCN research has already produced some promising results. The 2020 trial is now underway and we look forward to understanding more about the varieties available to tackle BCN.